Miocene - Pliocene mantle depletion event in the northern Fossa Magna, central Japan

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New isotopic and trace element data presented here imply a temporal change in magma sources and thermal conditions beneath the northern Fossa Magna from the Miocene to the Pliocene. Less radiogenic $^{176}Hf/^{177}Hf$ and $^{143}Nd/^{144}Nd$, and little or no Hf anomaly characterize the Early Miocene volcanism in the northern Fossa Magna region. The mantle wedge consisted of chemically heterogeneous mantle source. Based on out isotope proxies, we propose that during the onset of subduction, influx of hot asthenospheric mantle provided sufficient heat to partially melt newly subducting sediment. Geochemical modeling demonstrates that slab-derived melt mixed with mantle wedge produces the observed isotopic and trace elemental characteristics. In the Middle Miocene, the injection of hot and depleted asthenospheric material replaced the mantle beneath the northern Fossa Magna region. This caused the isotopic signature of the rocks to change from enriched to depleted. Then, the mantle wedge was gradually cooled during the Middle Miocene to the Pliocene with back-arc opening ending in the Late Miocene. Slab surface temperatures were still high enough for sediments to melt but not too high (<~780 C) to lose zircon as a residual phase. The Late Miocene and Pliocene volcanism at the post stage of the back-arc opening is best explained by a partial melting of subducted metasediment saturated with trace quantities of rutile, zircon, and monazite.